Liston Range Rear Light, 1876
2,600 feet east of U. S. 13 on County Road 2
Biddles Corner
New Castle County
Delaware

HAER DE-10

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
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HISTORIC AMERICAN ENGINEERING RECORD

LISTON RANGE REAR LIGHT
[Originally known as Port Penn Range Rear Light]

HAER DE-10

Location:	Near Biddles Corner, Newcastle County, Delaware. 2600 feet east of U. S. 13 on County Road 2. (Just south of C & D Canal.) UTM: 18.445000.4374885 Quad: Saint Georges
Date of Construction:	1876-77
Present Owner:	U. S. Government (Light serviced by U.S. Coast Guard Station at Gloucester, New Jersey.)
Present Use:	Still functions as a range light along the Delaware River.
Significance:	The Liston Range Rear Light merits attention for two reasons. First, it is a river range light--a type virtually ignored in the historical literature on lighthouses. Secondly, it is a wrought iron structure, and therefore atypical. The U. S. Light-House Establishment more often constructed its iron lighthouses out of cast iron.
Historian:	Larry D. Lankton, August, 1976

The Delaware River has long been a major transportation route important to the commercial development of its contiguous states and to cities such as Wilmington and Philadelphia. In terms of the river's navigability, the stretch of the Delaware from Philadelphia to Delaware Bay is quite broad, but not particularly deep. Its main channel passes alongside numerous shoals and islands, and these hazards sometimes made navigation of the Delaware a dangerous proposition. Recognizing this danger, and hoping to minimize it, in the second half of the 19th century the U. S. Light-House Establishment set about the task of marking portions of the Delaware's main channel with range lights. These lights operated in pairs and stood on a line representing an elongation of the axis of the river's channel. A front light, mounted on a low tower or house, stood near the river's edge. A rear light, supported on a much taller structure, stood at an inland location, a considerable distance behind the front light. When a mariner saw the two lights--one shining directly above the other--he knew that his vessel was on the line of the river's channel and passing clear of islands and shoals.

In the early 1870's the Light-House Establishment proposed the erection of range lights to mark the channel of the Delaware from Reedy Point south to Ship John Shoal [Photo DE-10-1]. The river ran some 20 statute miles between these points, and in the course of this run it made one broad turn in the vicinity of Stony Point. In order to mark this portion of the river, the Light-House Establishment called for the construction of two pairs of range lights. One pair would light a line corresponding to the channel north of the turn at Stony Point; the other would light the channel line south of the turn. On 3 March 1875, the U. S. Congress approved the construction of these lights (referred to collectively as the Liston's Tree Range Lights), and in 1876 Congress appropriated $55,000 for the work. [1]

The Light-House Establishment initially planned to erect all 4 of the Liston's Tree Range Lights (2 front and 2 rear) in Delaware, on the western side of the river. But one landowner demanded too great a price for the site of one front light (the site was unreclaimed swampland), so that light and its mate were moved over to New Jersey. [2] The Light-House Establishment located the lights to mark the channel south of Stony Point about 1-3/4 miles below Port Penn, Delaware--and called them the Port Penn Range Lights. [3] The lights to mark the channel north of Stony Point were located near Finn's Point, New Jersey--and became known as the Finn's Point Range Lights.

After locating the lights, the Light-House Establishment designed the structures, taking into account their distance from the river, the elevations of their sites, and the length of the ranges they

were to light. In the case of both front lights, located right on the river's edge, the Light-House Establishment called for lamps and catadioptric range lenses supported some 40 feet above mean low water on wooden-framed structures pained white. [4] For the rear lights, the Establishment chose to erect tall skeletal iron towers. Since at least 1860, iron had been used more and more as a light-house building material for several reasons. [5] Compared to wood, it was a stronger, more durable material--a material better suited for a tall structure. Compared to masonry, it was less expensive. Also, an iron tower could be erected more quickly than a masonry one because it could be pre-fabricated by the builder. Indeed, the Light-House Establishment required the builder of these towers to erect them at his own place of business, where they were inspected. After passing inspection, matching parts were marked to facilitate re-erection on the building site, and the towers were taken down, crated, and shipped. [6] The prefabrication of the iron towers had one other important advantage. If the need arose, an iron tower could be easily dismantled and moved to a new location. [7]

In one significant respect, the rear lights for the Port Penn and Finn's Point ranges differed from many other iron towers erected by the Light-House Establishment. They were made of wrought iron, instead of cast. Wrought iron, because of its corrosion resistance and its resistance to cracking, would have seemed a very appropriate choice for tall structures exposed to the elements and to wind loads. Nevertheless, the Light-House Establishment often resorted to cast iron.

On 18 April 1876, W. F. Raynolds, Brevet Brigadier-General and Engineer of the Fourth Light-House District, published a request for bids on the iron towers and detailed engineering specifications concerning their construction. [8] He made this information available to various iron manufacturers, and on 27 June 1876 the Kellogg Bridge Company of Buffalo, New York received a contract valued at $16,400 to erect the rear lights for both the Port Penn and Finn's Point ranges. [9] The Light-House Establishment provided the foundations, woodwork, range lenses and lamps; the Kellogg Bridge Company supplied all the metal-work and erected it, a task completed early in 1877. Except for the fact that the Port Penn light was almost 30 feet taller than the Finn's Point light, the two structures were identical in their building technology. Consequently, the description of the Port Penn tower which follows is in most respects applicable to both structures. [10]

General Description [11]

The Port Penn Range Rear Light measured 120 feet high from its base to the focal plane of its light. A skeletal iron tower, it had a central cylindrical shell built around a circular stairway [Photos DE-10-2, 3]. Both the skeletal framework and the central shell were founded upon masonry. The light had an entrance vestibule at the base and a watchroom and lantern at the top.

Foundation

The masonry foundation consisted of 7 separate footings: a central footing under the staircase shell [Photo DE-10-4], and 6 peripheral footings [Photo DE-10-5], equidistant from the center of the tower, which anchored the skeletal part of the superstructure. Formed of stone laid in mortar, the footings were 8 feet deep overall, and each was laid over a wrought iron plate. Wrought iron anchor bolts ran from each plate up through the masonry and secured the superstructure. Six 1-inch bolts ran through the central footing; two anchor bolts ran up through each of the 6 peripheral footings.

Skeletal Framework

Six "vertical" supports rose from the peripheral footings to the floor of the lantern gallery. These were constructed of 9-inch wrought iron I-beams (weighing 84 pounds per yard) that were rolled by the Union Iron Company of Buffalo, New York. [12] The supports rose on a slope of 1 horizontal to 6 vertical, and each support was formed of 5 sections [Photo DE-10-6]. Where the sections joined, the 9-inch I-beams were butted together; two 1/2 inch channel irons were set in against the web and the inside of the flanges; and two 1/2 wrought iron plates were set against the outside of the flanges. The channel irons and plates extended 12 inches on each side of the joint. This assembly was secured by 5/8 inch rivets.

The bases of the supports butted against iron foot-plates, 3/4 of an inch thick, that measured 24 inches by 15 inches. These foot-plates rested on top of the peripheral masonry footings and were secured by hex nuts screwed onto the ends of the 1-inch anchor bolts. The supports were secured to the foot-plates with riveted angle irons. Riveted angle irons also secured the tops of the supports to the central tower or shell, just below the lantern gallery.

From each joint in each support, horizontal braces ran out to the two adjacent supports. Also, a radial brace ran from the joint into the staircase shell. These braces were formed by means of 3-inch by 3-inch angle irons and rivets. In addition to the horizontal braces, adjacent supports were connected by diagonal tie rods, and tie rods also ran from each support into the staircase shell.

These tie rods varied in diameter from 1 inch near the top of the structure to 1-1/2 inches at the base, and they carried sleeve-nuts, so that the tension on each rod could be adjusted.

Staircase Shell and Vestibule

The staircase shell was 8 feet in diameter and formed of 30 wrought iron "bands" which were 48 inches high (except for the uppermost band). Each band was formed of two 1/4-inch thick plates, lapped and riveted, and each band overlapped the one beneath it by 3 inches and was secured at the lap with 3/4-inch rivets placed 3 inches apart, center to center. The bottom band butted against a circular wrought iron base plate; this band was secured to the plate with riveted 3-inch by 3-inch curved angle irons. The base plate in turn was fastened to the central footing by hex nuts screwed onto the six 1-inch anchor bolts running through the masonry.

The shell was painted black on the outside and lined on the inside with tongue-and-groove siding painted white. Appropriate openings were left in the shell and lining to receive 5 cast iron window frames which carried wooden sash windows. An opening was also left at the base of the shell to receive the iron plates which formed the vestibule. The vestibule was essentially constructed of cast iron, but galvanized iron was used for the cornices and dentils forming the classical pediment. [13] [Photo DE-10-7] The vestibule contained two cast iron window frames and two doors. The outer door was a paneled door constructed of white pine, side-hinged, and painted white. The inner door, located at the juncture of the vestibule and shell, was a curved, sliding door constructed of 1/8-inch sheet iron. When opened, the door rolled on wheels to a position behind the shell's wooden lining.

Stairway and Watchroom

According to the engineering specifications, the Port Penn Range Rear Light had a circular stairway constructed around a central cast iron column; the stairway rose from the base of the light to the watchroom. There were 152 steps and 5 landings. Each of the first 5 flights consisted of 27 steps and 1 landing; the uppermost flight consisted of 17 steps that reached the watchroom floor.

The steps were cast iron, with treads 3/4 of an inch thick [Photo DE-10-8,9]. On the inside end, each step carried a ring which was turned down on the bottom and bored out at the top. This ring fitted around the tower's central column, and the base of each ring fitted into the ring immediately below it. The outside of each step carried a leg which reached down to the step below and accepted a bolt. The stairway landings consisted of cast iron gratings similar to the steps. The inside of each landing was secured by a ring; the outside edge was supported on curved angle irons riveted to the staircase shell.

The central cast iron column, approximately 9 inches in diameter, was composed of hollow, socketed sections having a wall thickness of 3/4 of an inch. Each section overlapped the one beneath it, except for the bottom section. This section carried a flange 18 inches in diameter and 1 inch thick that rested against the masonry of the central footing. The top section of the central column also carried an 18 inch flange, which served as an inside support for the watchroom floor.

The watchroom floor was semi-circular and formed of 2 ribbed, 3/4-inch plates, each occupying a quadrant. The inside edge of the plates bolted to the flange on the central column; the outside edge rested on 3-inch by 3-inch angle irons riveted to the staircase shell. A flanged cast iron column rising through the watchroom was bolted through the watchroom floor to the central column below. This column supported the lantern, which was reached from the watchroom via ladder-like stairs.

Lantern and Gallery

The lantern, the uppermost room in the structure, contained the lighting apparatus. Encircled by a gallery (access to which was through a sheet iron door set in a cast iron frame), the lantern had a diameter of 8 feet 8 inches. Its exterior shell was formed of wrought iron, in the same manner as the staircase shell. [14] In addition to being broken by a doorway, the lantern's shell was interrupted by a cast iron frame which received a 44-inch square window glass for the light.

The lantern floor was formed of cast iron plates provided with strengthening ribs on the underside. These plates were bolted together through the ribs, bolted to the top flange of the cast iron column rising through the watchroom, and the outside edges of the plates bolted to a 4-inch by 4-inch circumferential angle iron riveted to the exterior wrought iron shell. The circular gallery floor was also 3/4-inch cast iron plate, extending 2 feet 9 inches beyond the shell of the lantern. The gallery was surrounded by a railing made of gas-pipes, with 1-1/2 inch posts and 1-inch rails.

The conical lantern roof was formed of 6 sections of 1/4-inch plate iron supported on T-iron rafters. The roof was surmounted by a cast iron ventilator ball having 12 openings, and the inside of the roof was lined with sheet zinc. Around the roof ran a galvanized iron cornice and a gutter, which drained via a 2-1/2-inch pipe through the gallery floor.

Lighting Apparatus

The Light-House Establishment provided the structure with a range lens 29 inches in diameter having a prismatic reflector. Illumination was supplied by an oil-fired double-wick burner with a Funck lamp. The fixed white light shone 24 hours per day [15] and was tended by a keeper who lived on the light station in a small frame dwelling erected by the Light-House Establishment. [16]

The Port Penn Range Rear Light was first illuminated on 2 April 1877, and it continued to light the same 15 mile stretch of the Delaware channel until 25 October 1904. [17] On this date, the Port Penn Range Rear Light Station was abandoned because a new channel--30 feet deep and some 600 feet wide--had been dredged in the Delaware to allow for the passage of larger ships with deeper drafts. After the new channel was dredged, the Light-House Establishment had to build some new range lights along the river and relocate some old ones. The Port Penn Range Rear Light was one of those which was moved.

The Light-House Establishment moved the skeletal iron tower approximately 1-1/2 miles to the new Liston Range Rear Light Station, near Biddles Corner, Delaware. Philadelphia contractor John L Grim disassembled, moved, and re-erected the structure at a cost of about $5,345, or about one-third the cost of erecting a new iron tower of this height. [18] The move was completed and the tower re-lighted on 15 May 1906. Between 25 October 1904 (when the Port Penn Range was abandoned) and 15 May 1906, the Liston Range Rear Light Station was temporarily illuminated by a locomotive-type reflector light hoisted to the top of a 100-foot wooden pole. The same reflector light was used to illuminate the skeletal tower until 10 November 1906, when the tower received a new 2nd Order range lens with a prismatic reflector made by Barbier, Benard & Turenne of Paris, France [Photo De-10-10]. The prisms in the lens and reflector were set in brass fixtures bolted to a cast iron pedestal base. On the pedestal, between the lens and reflector, stood a 2nd Order oil-fired air-pressure lamp with 3 round wicks. [19]

To complete the Liston Range Rear Light Station in 1907 the Light-House Establishment erected a keeper's house, barn, and oil house. In circa 1913, it erected an assistant keeper's house. The 4-1/2-acre station remained manned until the mid-1930's, when the light was electrified. [20] Because the electric lamps did not demand constant attention, the keepers were discharged and the keepers' houses were sold to private individuals.

In 1976, the light was illuminated by a single 250 watt bulb mounted in an automatic lamp changer which held three standby bulbs.

Whenever a bulb burned out, the changer automatically cycled to a new one. The light was serviced only once or twice a month by the U. S. Coast Guard Station in Gloucester, New Jersey.

As noted above, the light tower has been electrified, moved once, and its lens and reflector have been replaced. Several other changes have occurred. At an undetermined time (perhaps when the structure was moved), the inner sliding door in the vestibule was removed. Also, the circular starway was terminated a short distance below the watchroom, and entrance to that room afterwards was made through a small hatch via ladder-like stairs. Because these stairs took up less space, the floor space in the watchroom was increased. Fairly recently, the U. S. Coast Guard removed all the old decaying windows in the tower and covered all the window frames with sheet steel. It also replaced the wooden entrance door with one fabricated of sheet steel. Yet despite all these changes, the tower in 1976 remained very much like it was when first built.

NOTES

[1] Clipping file, "Port Penn Range Light Stations--Delaware," Record Group No. 26, National Archives.

[2] Clipping file, "Port Penn Range Light Stations--Delaware," entry for 1876.

[3] The locations of these lights were as follows:
front--latitude 39 degrees, 29 minutes, 30 seconds North
longitude 75 degrees, 35 minutes, 22 seconds West

rear--latitude 39 degrees, 30 minutes, 40 seconds North
longitude 75 degrees, 36 minutes, 37 seconds West

[4] Office of the Light-House Board, "Notice to Mariners, No. 9, 1877," Record Group No. 26, National Archives.

[5] See Arnold Burges Johnson, The Modern Light-House Service (Washington, D.C.: G.P.O., 1899), pp. 28-29.

[6] See U. S. Light-House Establishment, "Iron Light-Houses for Liston's Tree Range Lights," (Philadelphia: Office of Light-House Engineer, Fourth District, April, 1876), p. 15. Located in Specifications for Lighthouse Structures, Record Group 26, National Archives.

[7] In 1881, the Light-House Board recommended the erection of an iron tower at Cape San Blas, Florida. It wrote: "It is recommended that a skeletal iron tower be erected; then if the sea again encroaches, it could be taken down and re-erected." Quote taken from U. S. Coast Guard, Historically Famous Lighthouses, CG-232 (Washington: G. P. O., 1972), p. 19.

[8] "Iron Light-Houses for Liston's Tree Range Lights."

[9] Abstracts of Contracts, 1877-1897, Record Group No. 26, National Archives.

[10] While the Liston Range (Old Port Penn) Rear Light continued in service in 1976, the Finn's Point light had long since been abandoned. Nevertheless, it was still standing, although in a very delapidated state.

[11] This description is drawn from the engineering specifications contained in "Iron Light-Houses for Liston's Tree Range Lights," pp. 7-13. The specifications were checked against the physical structure; deviations are noted later in the text or notes.

[12] The maker's name was rolled into the I-beams.

[13] The classical pediment was not unique to Liston's Tree Range Lights. See the drawing of the Hunting Island, South Carolina lighthouse in Johnson, The Modern Light-House Service, between pages 28-29.

[14] In 1976, the exterior shell of the lantern carried two kick-outs or bulges which provided more room for a keeper to get by the lighting apparatus. These kick-outs were not mentioned in the engineering specifications. They may have been added in 1906 when the tower was moved and a larger lens was installed.

[15] "Liston's Tree Range Lights--Rear Beacon, Port Penn," 4th Light-House District Sites, Record Group No. 26, National Archives.

[16] The 1876 keeper's house still survives on the original site of the light.

[17] Clipping file, "Port Penn Range Light Stations--Delaware."

[18] Light-House Correspondence, File No. 7634, Series 1900-1910 Record Group No. 26, National Archives.

[19] Clipping file, "Liston Light Range," Record Group No. 26, Natonal Archives.

[20] "Liston Range Rear Lt. Sta.--Map of Reservation, 1938," Site File, Delaware No. 20, Record Group No. 26, National Archives.

BIBLIOGRAPHY

National Archives, Record Group No. 26.

"Abstracts of Contract, 1877-1897."

Clipping file. "Liston Light Range--Delaware."

Clipping file. "Port Penn Range Light Stations--Delaware."

Light-House Correspondence. File No. 7634, Series 1900-1910.

"Liston Range Rear Lt. Sta.--Map of Reservation, 1938." In Site File, Delaware No. 20.

"Liston's Tree Range Lights--Rear Beacon, Port Penn." In 4th Light-House District Sites.

Office of the Light-House Board. "Notice to Mariners, No. 9, of 1877."

U.S. Light-House Establishment. "Iron Light-Houses for Liston's Tree Range Lights." Philadelphia: Office of Light-House Engineer, Fourth District, April, 1876.

Other Sources

Board of United States Engineers. Thirty Foot Channel from Philadelphia to the Sea. Philadelphia: Joint Committee on the Improvement of the Harbor of Philadelphia and the Delaware and Schuylkill Rivers, 1899.

Johnson, Arnold Burges. The Modern Light-House Service. Washington, D.C.: G. P. O., 1899.

U. S. Coast Guard. Historically Famous Lighthouses. Washington,D.C.: G.P.O., 1972.